

FIELD OF INVENTION

10 In a data transmission environment, it is common to
need to transmit different categories of data between a
transmitter and one or more receivers. Where this data is
generated independently, some form of control must be
implemented to optimise the use of the transmission medium
15 and the available bandwidth. Conventionally, data in
different categories is allocated a priority relating to
the degree of importance of the data so that high priority
data will be transmitted in preference to low priority
data. However, in some cases, problems arise where data
20 which is normally allocated a relatively low priority needs
to be transmitted in preference to higher priority data.

WO-A-94/14284 discloses a reprogrammable terminal and a central network controller which is able to respond to the immediate need of a set top terminal by modifying a program control information signal received from an operations centre. Thus, the network controller responds to individual requirements of remote units. This, however,

is not relevant to the problem which the present invention addresses, namely handling the transmission of data centrally where the data is included in different categories with different priorities.

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SUMMARY OF THE INVENTION

In accordance with one aspect of the present invention, a method of transmitting data relating to a number of different categories, from a central location to at least one remote receiver comprises allocating a priority to the data to be transmitted in accordance with its category, the priorities defining a relationship between the different categories of the data; transmitting the data in a manner determined by the allocated priorities; monitoring the data to be transmitted to determine whether the data will be transmitted in a satisfactory manner; and, if necessary, changing the priority of any data which has not yet been transmitted so that it will be transmitted satisfactorily.

In accordance with a second aspect of the present invention, apparatus for transmitting data relating to a number of different categories, from a central location to at least one remote receiver comprises a processing system for allocating a priority to the data to be transmitted in accordance with its category, the priorities defining a relationship between the different categories of the data; and means for transmitting the data in a manner determined by the allocated priorities, the processing system being adapted to monitor the data to be transmitted and to determine whether the data will be transmitted in a satisfactory manner, and if necessary, to change the priority of any data which has not been transmitted so that it will be transmitted satisfactorily.

With this invention, the data to be transmitted is monitored to determine whether or not the data can be transmitted in a satisfactory manner. If it cannot then

In general, the monitoring step comprises determining whether the data will be transmitted within a predetermined time period. Typically, each category of data will need to be transmitted within a certain time period of its generation or supply to the transmitting means and the monitoring step determines whether or not the data will be transmitted within that time. For example, the processing system may allocate a maximum time by which particular data must be transmitted and these times may vary depending on the data concerned.

In order further to optimise the use of the available bandwidth in the transmission medium, where the data is transmitted in packets, each packet containing data of different categories, the method may further comprise monitoring a packet to be sent and if space remains in such a packet, the space being insufficient to accommodate data allocated a relatively high priority, incorporating lower priority data into the space prior to transmission. This allows background trickle feeds of operating systems and upgrades to be transmitted in an optimum manner even though these are normally allocated a relatively low priority.

It will be appreciated that there are a vast number of different categories of data which could be processed using the method. The applicants are particularly concerned with methods in which some of the categories are chosen from background game playing data, real time game playing data,

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typically be remote not only from the system B but also from each other.

5 The signals supplied to the combiner 6 may be transmitted to the remote units within a vertical blanking interval (VBI) of the normal TV signal or on a separate radio FM-SCA channel or other data format such as a cable modem.

10 Other forms of transmission including satellite, cable and the internet may also be used to send signals to the remote user C.

Each remote user C, only one shown in Figure 1, has a home or remote unit 9 connected to a television receiver 10 having an aerial 11 and a monitor 12. The home unit 9 includes an address/data bus 13 connected to the receiver 15 10, the bus 13 being connected to a microprocessor 14, a ROM 15 storing programme instructions for the processor 14, an input device 16 such as a keyboard or mouse, a first store (RAM) 17 for storing data supplied from the central controller 1, and a second signal store (RAM) 20 for storing data defining the identity of the remote unit 9 and the services to which the remote user has subscribed. Signals transmitted by the processor 14 can be communicated to the central controller 1 via a public switched telephone network 18 which is selectively accessed by a telephone 25 interface unit 19 connected to the bus 13. Other media may be used for the return transmission including TV broadcast, cable, satellite and the internet. In general the return signal medium will be different from the medium used to transmit to the remote user C.

30 The game control system A can generate data relating to a variety of games some of which may be associated with television broadcasts from the studio 7. For example, one game may allow remote users to predict the occurrence of certain events in a live event being broadcast, such as a 35 live football match. In addition, the game control system A can generate signals to individual or groups of remote units which include data such as operating system upgrades

and signals for enabling or disabling certain services. As explained above, in general, each type of service category is allocated a particular priority and this is used to determine the order in which the data is transmitted.

5 Thus, operating system upgrades and enablement/disablement instructions may have a relatively low priority while live game information will have a high priority.

Ans. a) The manner in which data is handled within the central controller 1 can be seen in more detail in Figure 2. As
10 shown in Figure 2, the central controller 1 includes an address/data bus 30 to which is connected a microprocessor 31 and a data store 32. Data to be transmitted is obtained by the processor 31 in response to input instructions from the central operator via the input device 2 and from the
15 store 4 and is supplied and stored in the data store 32. A very simple structure for the data store is shown in Figure 2 with each line corresponding to an individual address, the addresses being labelled on the left hand side 1,2,3 etc. The store 32 has a data section 33 and a
20 priority section 34 in which is stored a priority value for the data at the corresponding address. Thus, in this example, the data at address 1 has priority 5, the data at address 2 has priority 2, and so on.

A pointer queue store 35 is provided in which the
25 addresses of the data in the store 32 are stored in priority order. Thus, address 1 is stored first since the data at this address has the highest priority followed by address 3, address 4, etc.

Finally, a packet store 36 is connected to the bus 30
30 within which a data packet is built up by the microprocessor 31 as will be described below. Once the packet is complete, the processor 31 will cause it to be transmitted via an interface 37 to the combining unit 6 for transmission.

35 The operation of the processor 31 when building up a data packet for transmission will now be described with reference to the flow diagram shown in Figure 3. As shown

at step 40, the microprocessor 31 will store incoming data in successive addresses within the store 33 and will also insert the address of the latest received data in the appropriate position in the pointer queue store 35 depending upon its priority (step 41). Each set of data will have, in addition to its priority, a certain time by which it needs to be received by the remote unit. The processor 31 monitors this time and determines regularly whether or not the data will be transmitted by that due time in accordance with its position within the pointer queue store (step 42). As the due time approaches for any particular set of data, the microprocessor 31 will increase the priority of that data to ensure that the due time is met (step 43) and correspondingly adjust the content of the pointer queue store 35.

At regular intervals, the microprocessor 31 will also build up a data packet for transmission in the store 36 (step 44). Each data packet will include a header portion 38 which includes data defining the identity or identities of remote units which are to receive the data packet, by including their identities as stored in their stores 20, or defining particular services to which the subsequent data in the packet relates. In a data storage section 39, the microprocessor 31 transfers data from the data store 32 in a sequence corresponding to the sequence of addresses in the pointer queue store 35 and hence in priority order. In this example, the data at addresses 1 and 3 has been stored at locations 39A and 39B. However, in this case, the remaining space in the packet is too small (step 45) to accommodate the data at address 4 which would normally occur next. In order to optimise the use of the packet, the microprocessor 31 has therefore transferred (step 46) data at address 2 into location 39C. Once the packet has been made up, the data in the packet is transferred via the interface 37 to the combining unit 6 for transmission (step 47).

In some cases, one or more of the priority levels allocated to the data may also cause the microprocessor 31 to compress the data so that compressed data is transferred into the packet store 36 which will therefore take up less space and be transmitted more quickly.

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